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Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

CONTINUATION OF THE INTEGRATED VAAL RIVER SYSTEM RECONCILIATION STRATEGY STUDY (PHASE 2)

Water Requirements

Working Document
September 2018

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water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

DIRECTORATE: NATIONAL WATER RESOURCE PLANNING

CONTINUATION OF THE VAAL RIVER SYSTEM RECONCILIATION STRATEGY STUDY (PHASE 2)

WATER REQUIREMENTS

SEPTEMBER 2018

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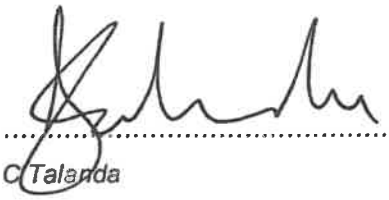

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

AMD	Acid Mine Drainage
AOA	Annual Operating Analysis
DWS	Department of Water and Sanitation
IVRS	Integrated Vaal River System
LHWP	Lesotho Highlands Water Project
NWRP	National Water Resource Planning
WC/WDM	Water Conservation and Water Demand Management

1 INTRODUCTION

1.1 Introduction and Background

The Department of Water and Sanitation (DWS) has commissioned a three-year study (2018 - 2020), the Continuation of the Vaal River System Reconciliation Strategy Study (Phase 2). The study was commissioned as a further endeavour to reconcile the current and future water requirements with the available water by implementing appropriate interventions to increase the available water, conserve water through conservation and water demand management measures as well as improve the water quality in the river systems.

The initial Reconciliation Strategy for the Vaal River System was developed in 2009 and was a culmination of the three parallel processes listed below:

- Development of an Integrated Water Quality Management Plan (**DWAF, 2008c**).
- Determine the Potential Savings through Water Conservation and Water Demand Management (WC/WDM) in the Upper and Middle Vaal Water Management Areas (**DWAF, 2006b**).
- Development of Large Bulk Water Supply Reconciliation Strategy for the Vaal River System **(DWAF, 2009)**

The initial Reconciliation was then followed by the Continuation of the Vaal River System Reconciliation Strategy (Phase 1), which was completed in 2015 and had a similar objective to this study, namely to the track progress with the implementation of the strategy actions, review key factors that influence the projected water balance and identify further water resource planning and management interventions deemed necessary to maintain a positive water balance for the next 30 years.

The study area comprises the Vaal River Catchment and all the adjacent water resource systems linked though conveyance systems as depicted in the study area geographical map shown in **Figure 1-1**.

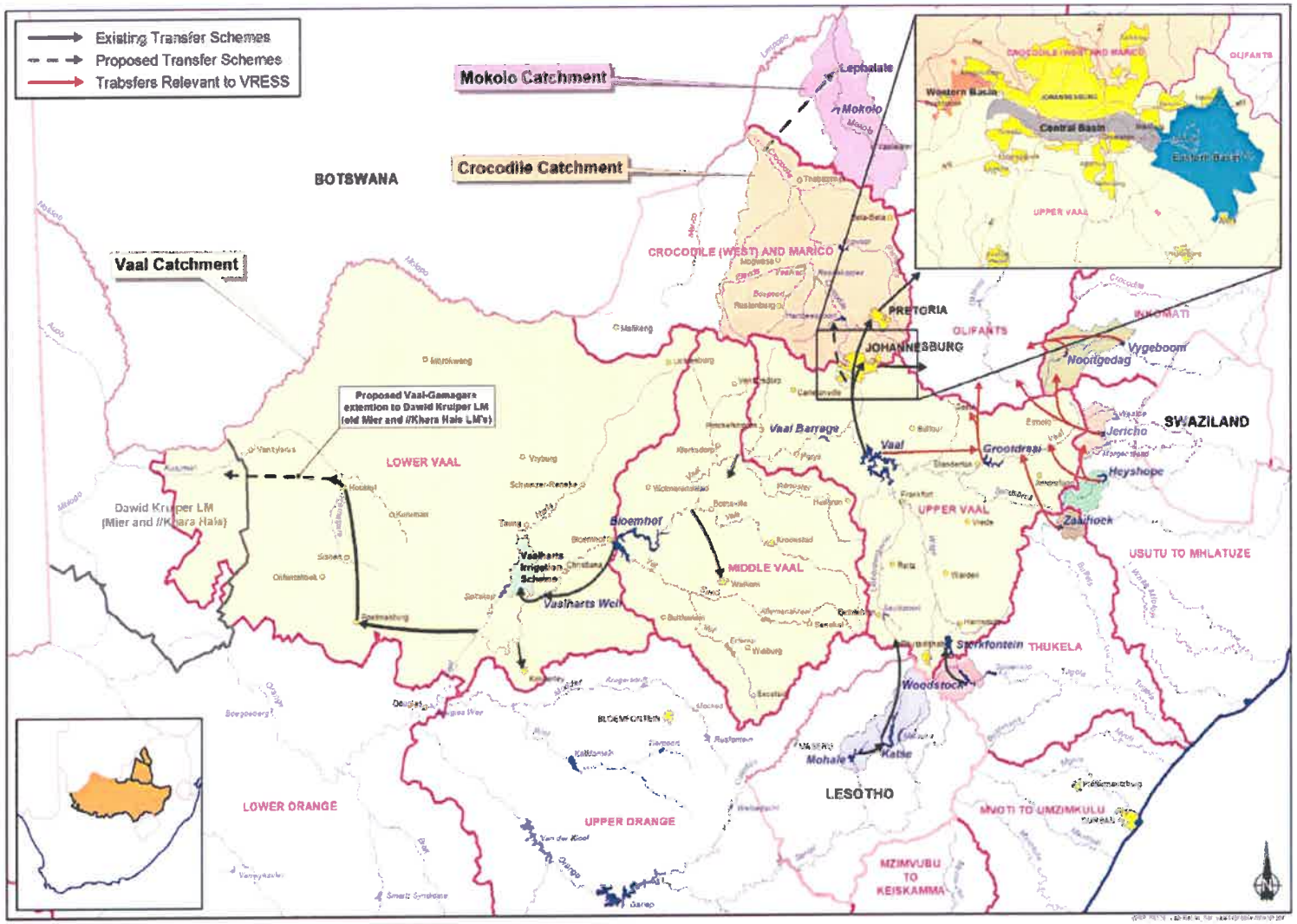

Figure 1-1: Study Area

1.2 Purpose and layout of this report

The primary purpose of this report is to document the status of the current and projected water requirements of the various water use sectors that have been included in the Reconciliation Strategy. This document will be updated with new information, as this becomes available during the course of the study over the three year study period. The final document will include the most recent information on the current and projected water requirements for the study.

2 WATER REQUIREMENTS

A summary of the historic and projected water requirements for the main water users that are being continuously tracked and monitored are presented and discussed in the subsequent sections.

2.1 Rand Water

Rand Water provided two alternative water requirement projection scenarios, which were adopted for assessment in the 2018/2019 AOA undertaken as part of this study. Rand Water Projection for Scenario A excludes any interventions while for Scenario B assumes the successful implementation of Rand Water Project1600, until Lesotho Highlands Water Project (LHWP) Phase 2 has been implemented.

The historical water use, the Rand Water projections as well as the previous projections, are shown in **Figure 2.1**. The restrictions implemented in the 2016 operating year are visible on the actual use. Past experience shows, however, that the future projections return to the previous growth trend (as in the 1994 to 1997 period) and this has been assumed in the water requirement projections used as presented.

The historical Rand Water use and the Rand Water projections are presented in

Table 2.1 and **Table 2.2** respectively.

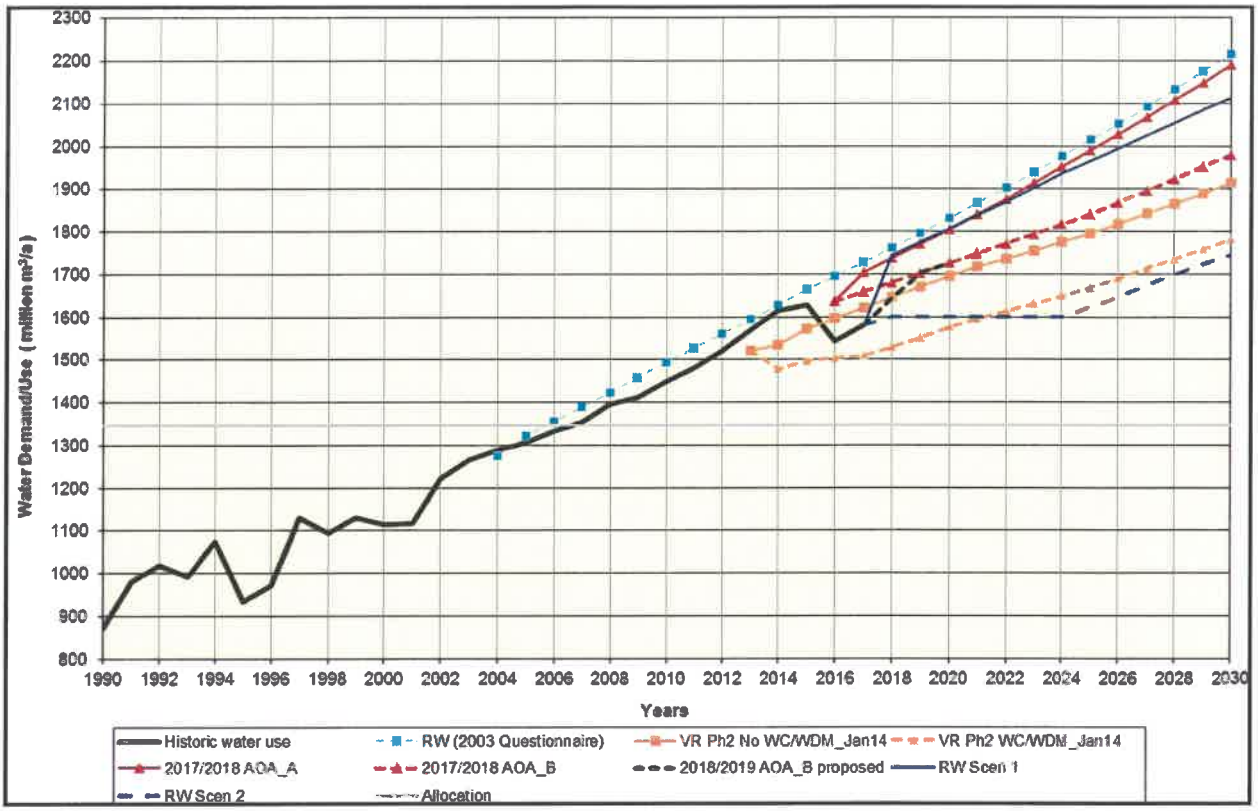

Figure 2.1: Rand Water: Comparison of actual water use and demand projections

Table 2.1: Rand Water Historic Water Use

Rand Water	Historic Water Use (million m³/a)								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
Historic Water Use	1410.7	1450.0	1481.2	1521.6	1569.1	1614.0	1628.8	1543.2	1580.3

Table 2.2: Rand Water Projected Water Use

Rand Water	Projected Water Use (million m3/a)						
	2018	2020	2022	2024	2026	2028	2030
Scenario A	1744.0	1807.0	1870.0	1936.0	1995.0	2055.0	2113.0
Scenario B	1600.0	1600.0	1600.0	1600.0	1648.0	1698.0	1746.0

2.2 Midvaal Water Company and Sedibeng Water

Midvaal did not provide an updated projection in water requirements, and the same projection as used in the 2017/2018 AOA was adopted for the 2018/2019 analyses. The historical water use, adopted projection as well as past projections are presented in **Figure 2.2**.

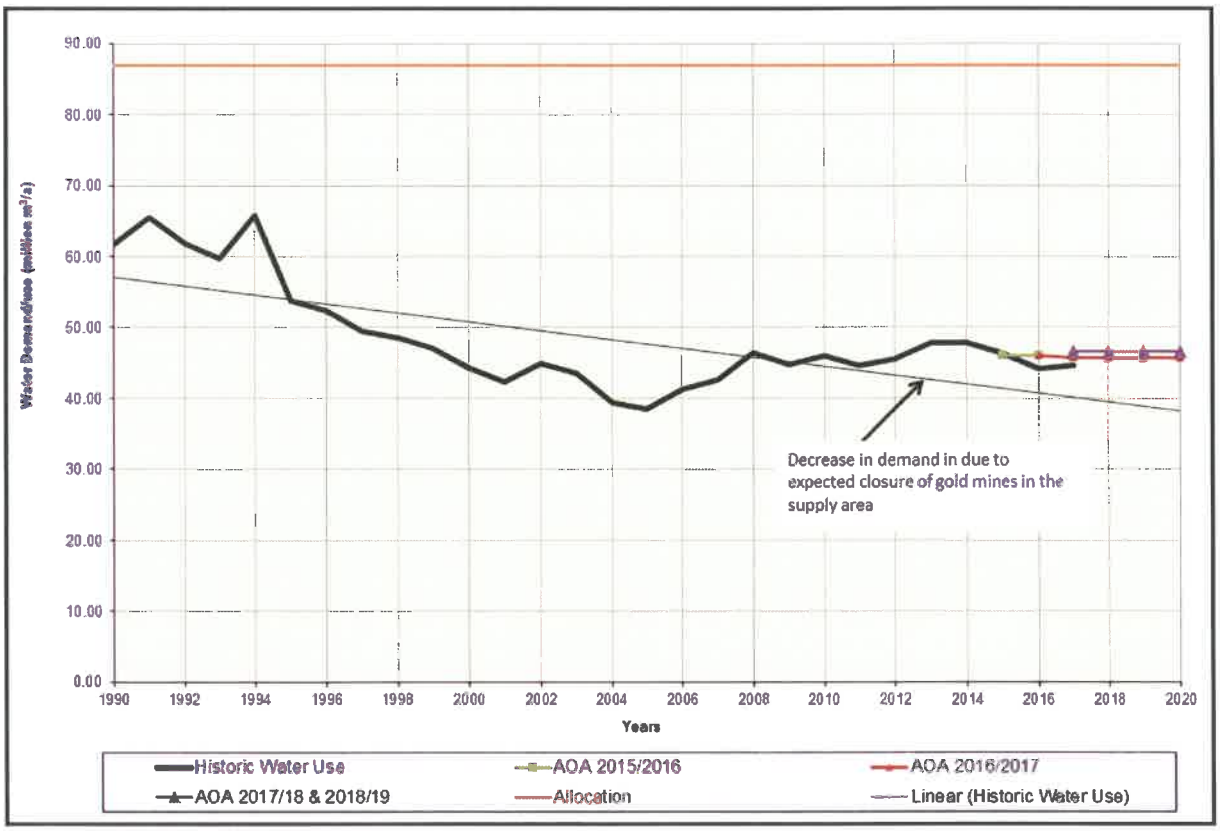

Figure 2.2: Midvaal Water: Comparison of actual water use and demand projections

Sedibeng submitted a total water requirement projection in April 2018. As a result of the storage level on Allemanskraal dam, it was assumed that the full allocation of Sedibeng from the Sand system (13.7 million m^3/a) could be supplied. This volume was subtracted from the total requirement in order to obtain the net requirement from the Vaal system. The historical water use, adopted projection as well as past projections of the net requirement from the Vaal system are presented **Figure 2.3**.

The Midval and Sedibeng historical and projected water use are presented in

Table 2.3 and **Table 2.4** respectively.

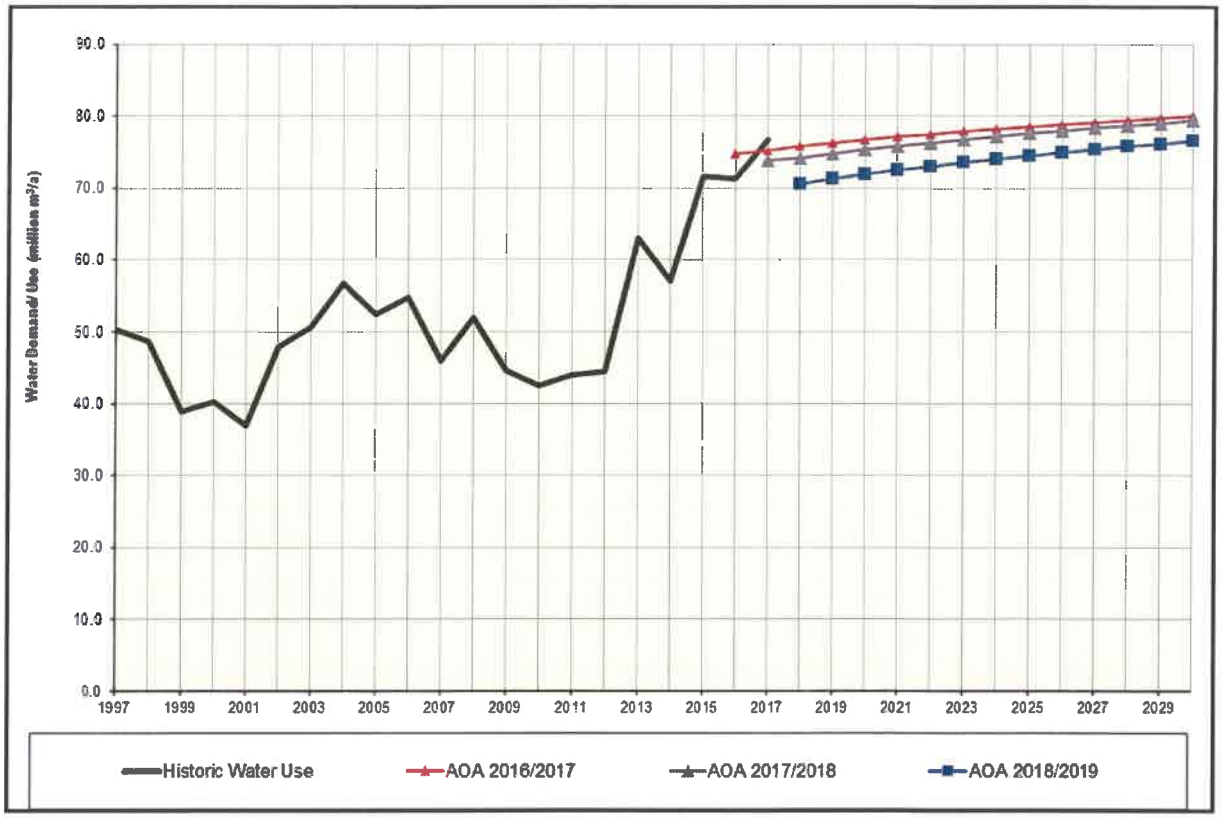

Figure 2.3: Sedibeng Water: Comparison of actual water use and demand projections

Table 2.3: Midvaal and Sedibeng Historic Water Use

User	Historic Water Use (million m³/a)									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Midvaal	46.5	44.8	46.0	44.6	45.5	47.8	47.8	46.2	44.1	44.5
Sedibeng	52.0	44.5	42.4	44.0	44.4	63.1	57.0	71.6	71.4	76.7

Table 2.4: Midvaal and Sedibeng Projected Water Use

User	Projected Water Use (million m³/a)						
	2018	2020	2022	2024	2026	2028	2030
Midvaal	46.5	46.5	46.5	46.5	46.5	46.5	46.5
Sedibeng	76.62	77.75	78.75	79.64	80.46	81.21	81.90

2.3 Eskom

ESKOM provided two water requirement projection scenarios in April 2018 namely a Tariff and a Base Scenario. From these alternative scenarios Eskom recommended that only the Base scenario be considered for the 2018/2019 AOA and that the Tariff scenario be used for the

calculation of the VRESAP tariff.

A graphical comparison with their previous water demand projections for the total IVRS is shown in **Figure 2.4**. The demand projection comparison for Power Stations supplied from the Eastern Sub-system of the IVRS is shown in **Figure 2.5.** From these comparisons it is clear that the April 2018 projections are similar to the April 2017 projections for the base scenario, however they are significantly reduced for the tariff scenario.

The historic and projected (base scenario) water use are presented in **Table 2.5** and **Table 2.6** respectively.

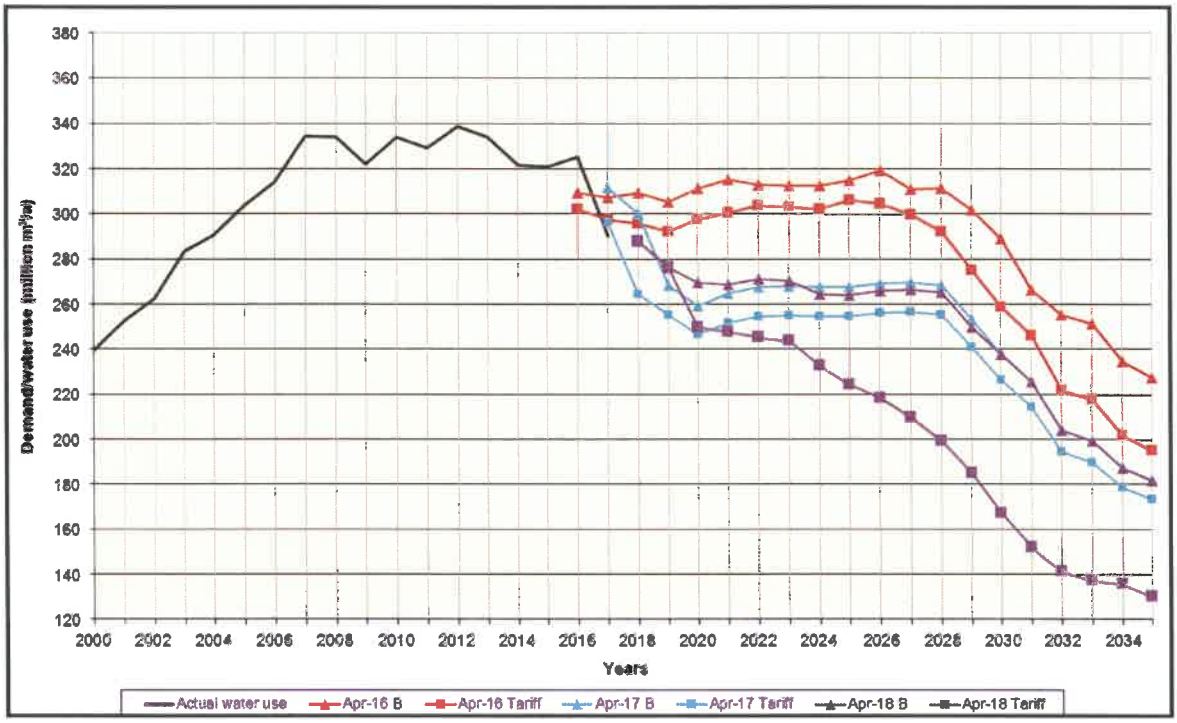

Figure 2.4: Eskom: Comparison of total demand projections supported from the total IVRS

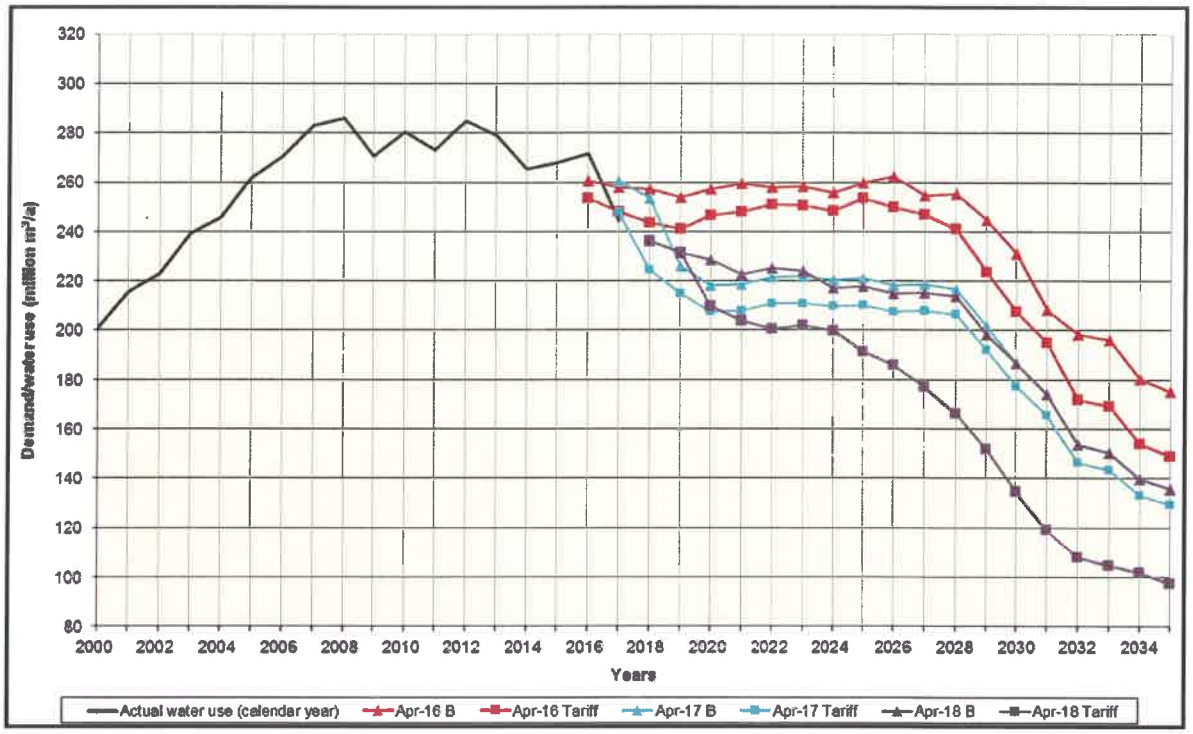

Figure 2.5: Eskom: Comparison of total demand projections supported from the Eastern Sub-system

Table 2.5: Eskom Historic Water Use

Eskom	Historic Water Use (million m³/a)									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total Vaal	334.1	322.1	333.8	329.2	338.5	334.1	321.6	320.8	325.0	290.1
Eastern Sub-system	286.1	270.6	280.4	273.2	284.9	279.0	265.4	268.0	271.5	244.4

Table 2.6: Eskom Projected Water Use

Eskom	Projected Water Use (million m³/a)						
	2018	2020	2022	2024	2026	2028	2030
Total Vaal (Base)	287.8	269.6	271.1	264.3	266.0	265.0	237.8
Eastern Sub-system (Base)	236.1	228.5	225.1	217.3	214.8	213.6	186.5

2.4 Sasol (Secunda and Sasolburg complexes)

Sasol has submitted revised raw water requirement projections in April 2018 for their Secunda and Sasolburg complexes. A comparison of some of the more recent water requirement projections for Sasol's Secunda and Sasolburg complexes are shown in **Figure 2.6** and **Figure 2.7**.

The April 2018 water requirement projection of the Secunda complex includes a 25 ML/d (9.13

million m³/a) intake from Rand Water until end June 2025 as per the Synfuels & Govan Mbeki Municipality/Rand Water supply agreement.

The Sasol Secunda and Sasol Sasolburg historic and projected water requirement projections are presented in **Table 2.7** and **Table 2.8** respectively.

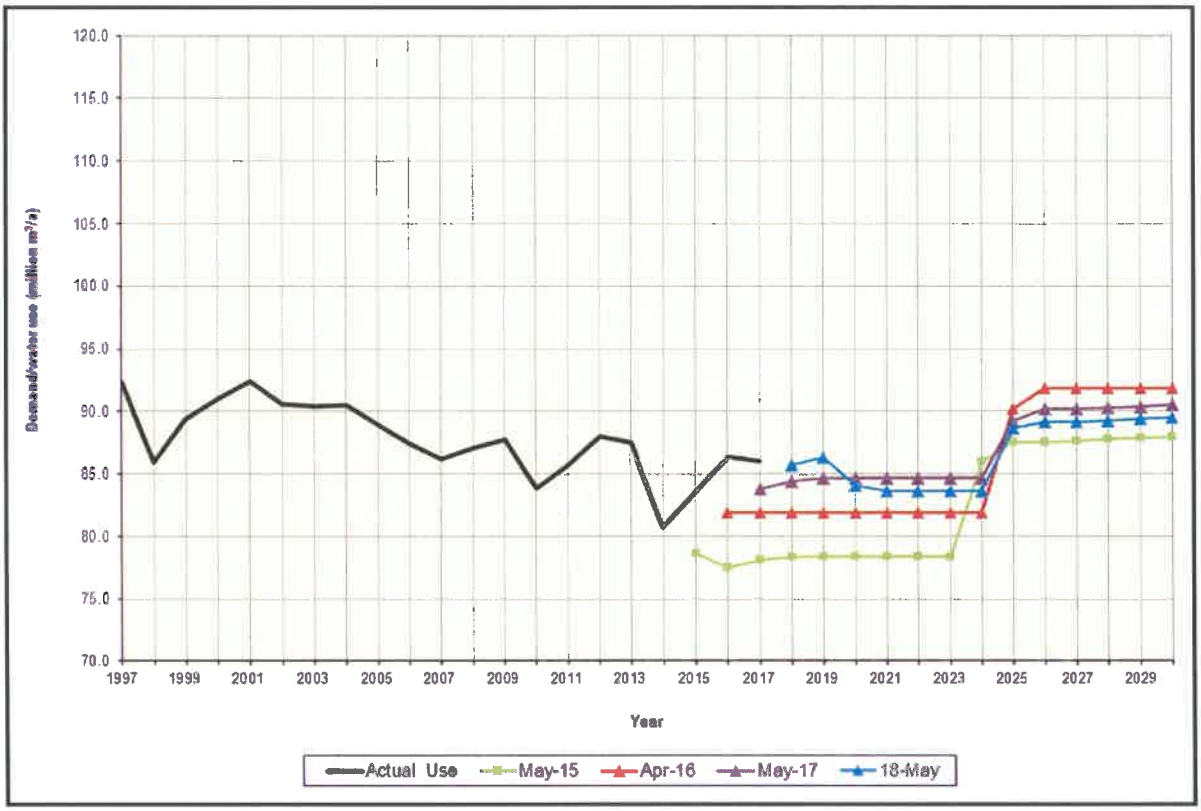

Figure 2.6: Sasol Secunda: Comparison of actual water use and projections

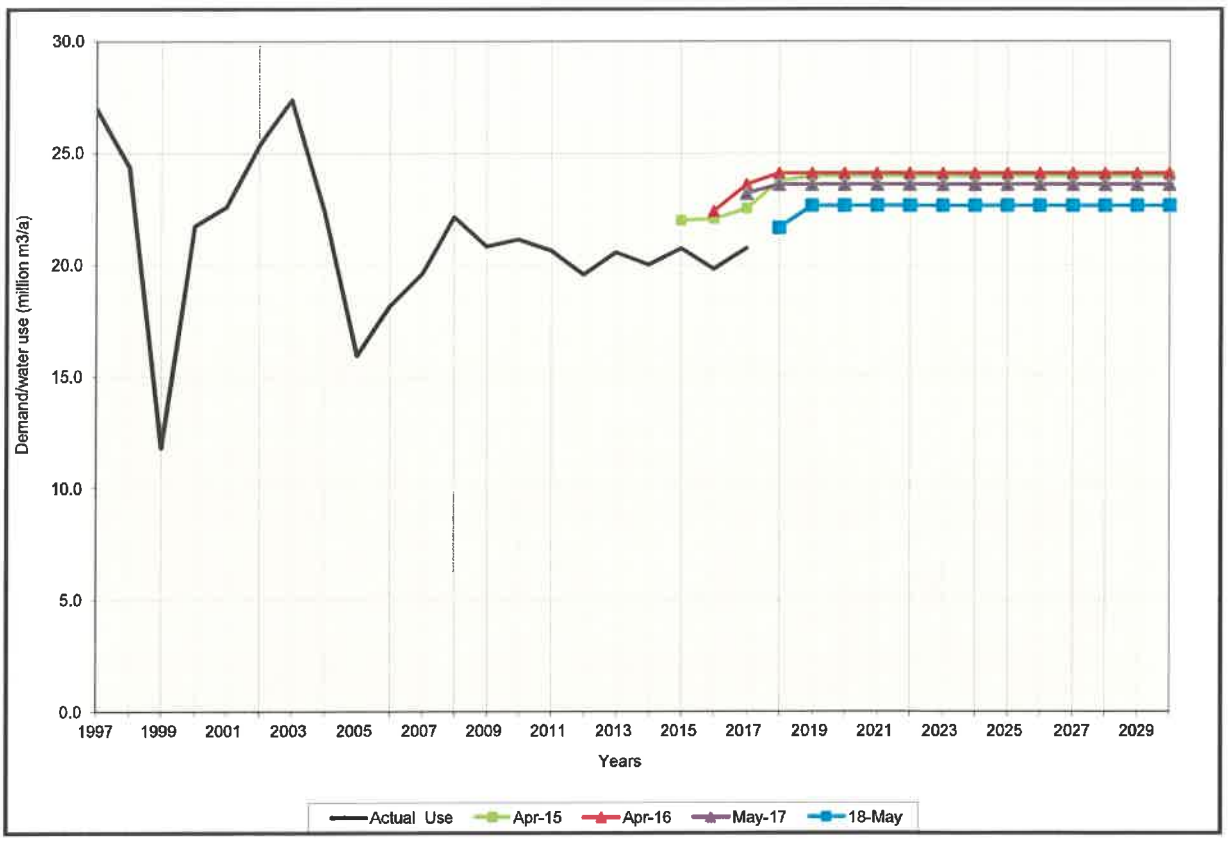

Figure 2.7: Sasol Sasolburg: Comparison of actual water use and projections

Table 2.7: Sasol Historic Water Use

Sasol	Historic Water Use (million m³/a)									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Secunda	87.1	87.7	83.9	85.7	88.0	87.5	80.8	83.7	86.4	86.0
Sasolburg	22.1	20.8	21.1	20.6	19.6	20.6	20.0	20.7	19.8	20.7

Table 2.8: Sasol Projected Water Use

Sasol	Projected Water Use (million m³/a)						
	2018	2020	2022	2024	2026	2028	2030
Secunda	85.7	84.1	83.7	83.7	89.1	89.3	89.5
Sasolburg	21.7	22.7	22.7	22.7	22.7	22.7	22.7

2.5 Mittal steel (Iscor)

No updated projections for Mittal Steel (previously known as ISCOR) were obtained and the projection used for the 2017/2018 AOA was therefore used again as presented in **Figure 2.8**. It should be noted that the projections shown in **Figure 2.8** reflect the total water requirements

and therefore include both the potable and raw water requirements that are supplied from Rand Water.

The Mittal historic and projected water requirement projections are presented in **Table 2.7** and **Table 2.8** respectively.

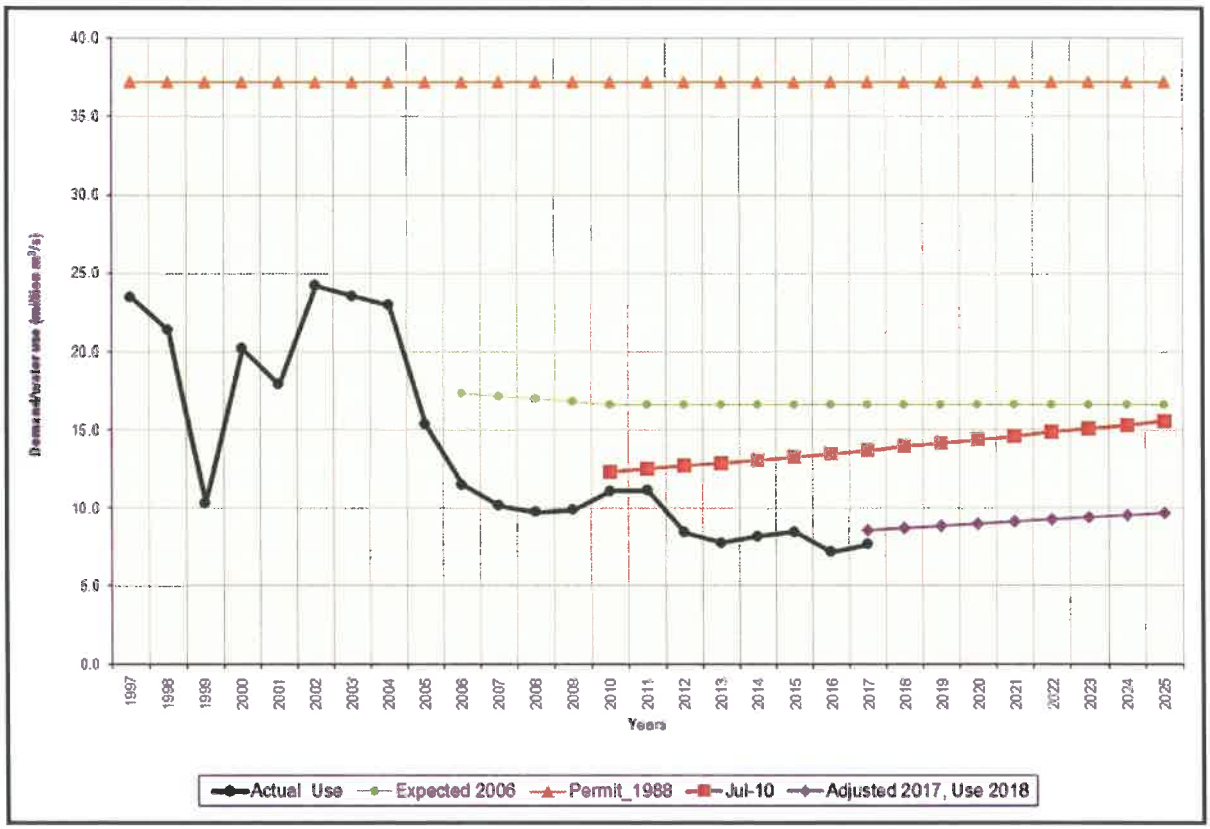

Figure 2.8: Mittal Steel: Comparison of actual water use and projections

Table 2.9: Mittal Steel Historic Water Use

Mittal	Historic Water Use (million m³/a)									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Actual Use	9.7	9.8	11.1	11.1	8.4	7.7	8.2	8.4	7.2	7.6

Table 2.10: Mitta Steel Projected Water Use

Mittal	Projected Water Use (million m³/a)						
	2018	2020	2022	2024	2026	2028	2030
Projected Use	8.7	9.0	9.3	9.6	9.9	10.2	10.5

2.6 Other towns and industries

No updated requirements were obtained for any of the other large towns and industries, and the requirement projections used for the 2017/2018 AOA (adopted from the DWS All Towns Study) were therefore used. These towns include the following:

- Breyten;
- Ermelo;
- Davel;
- Kriel;
- Hendrina;
- Amsterdam;
- Standerton;
- Morgenzon; and
- Driefontein.

2.7 Mine Dewatering

The mine dewatering information and potential re-use options are continuously updated. The most recent information was obtained from DWS Water Quality Planning (Central) and was adopted for the 2018/2019 AOA (**Table 2.11**). Based on this information the discharge volumes from the Eastern and Central basins are 27 Ml/d (2430 mg/l) and 23 Ml/d (3971 mg/l) respectively. The Western basin discharges 12.2 Ml/d (2696 mg/l) and discharges into the Corcodile (West) River Catchment. The mine dewatering information applied in 2016/2017 AOA and 2017/2018 AOA is also presented and it can be observed that there are no large changes from the 2017/2018 AOA. The desalination and re-use of this mine water is expected to commence in November 2020 (November 2022 for the delayed scenario).

Table 2.11: Mine dewatering data

Basin	2016/17 WRPM		2017/18 WRPM		Ob27.0served (Oct 2016-Sep 2017)		2018/19 WRPM		Start Desalination (Desalinated Water Re-used)	Discharge point
	Vol	DMS of Neutralized AMD	Vol	DMS of Neutralized AMD	Vol	DMS of neutralized AMD	Vol	DMS of Neutralized AMD		
	Mm^3/a	mg/l	$Mill\ m^3/a$	mg/l	$Mill\ m^3/a$	mg/l	$Mill\ m^3/a$	mg/l		
West	11.0	2776			12.2	2696			N/A	Tweelopies-spruit to Crocodile River
Central	25.6	4461	22.7	3995	23.0	3971	23.0	3971	Nov 2020	Elsburgspruit to Klip River
East	26.9	2647	25.1	2397	27.0	2430	27.0	2430	Nov 2022 (Delayed)	Blesbokspruit to Suikerbosrand River

2.8 Irrigation Water Requirements

No updates in irrigation water requirements were incorporated in the 2018/2019 analyses, and all values included for the 2017/2018 analyses were used.

2.9 Summary of Water Requirement Projections

The following water requirement scenario was considered for the 2018/2019 AOA.

Scenario A: This scenario represents the Base Scenario water requirement projection adopted for the 2018/2019 AOA of the IVRS comprises of the following demand projections of the individual users:

- Rand Water: Scenario 1 as provided by Rand Water;
- Eskom: Base scenario projection of April 2018;
- Mittal Steel: Projection used for AOA 2017/2018;

- Sasol Secunda: Projection provided April 2018;
- Sasol Sasolburg: Projection provided April 2018;
- Midvaal WC: Projection used for AOA 2017/2018;
- Sedibeng Water: Projection provided April 2018; and
- Small towns in VRESS: Projection used for AOA 2017/2018.

The **Scenario A** water requirement projection scenario is summarised in **Table A-1** of **Appendix A**. The net water requirements of the new demand projection scenario is compared against the net water requirements that were adopted for the previous AOA (2017/2018 AOA) in **Table 2.12**.

Table 2.12: Comparison of net water requirement projections (million m3/a)

DESCRIPTION	2018	2020	2025	2030
Base Demand (AOA 2017/2018)	3121	3147	3290	3424
Scenario A (AOA 2018/2019)	3125	3160	3282	3377
Differences between scenarios:				
Scenario A vs AOA 2011/2012	4	13	-8	-46

Figure 2.9 shows the net demand curves that are associated with the two projections summarised in **Table 2.12**. From **Table 2.12** and **Figure 2.9** it is clear that the demand projection scenario adopted for the 2018/2019 AOA is initially slightly higher than the projection adopted for the previous AOA. Towards the end the current curve is lower than last year's projection.

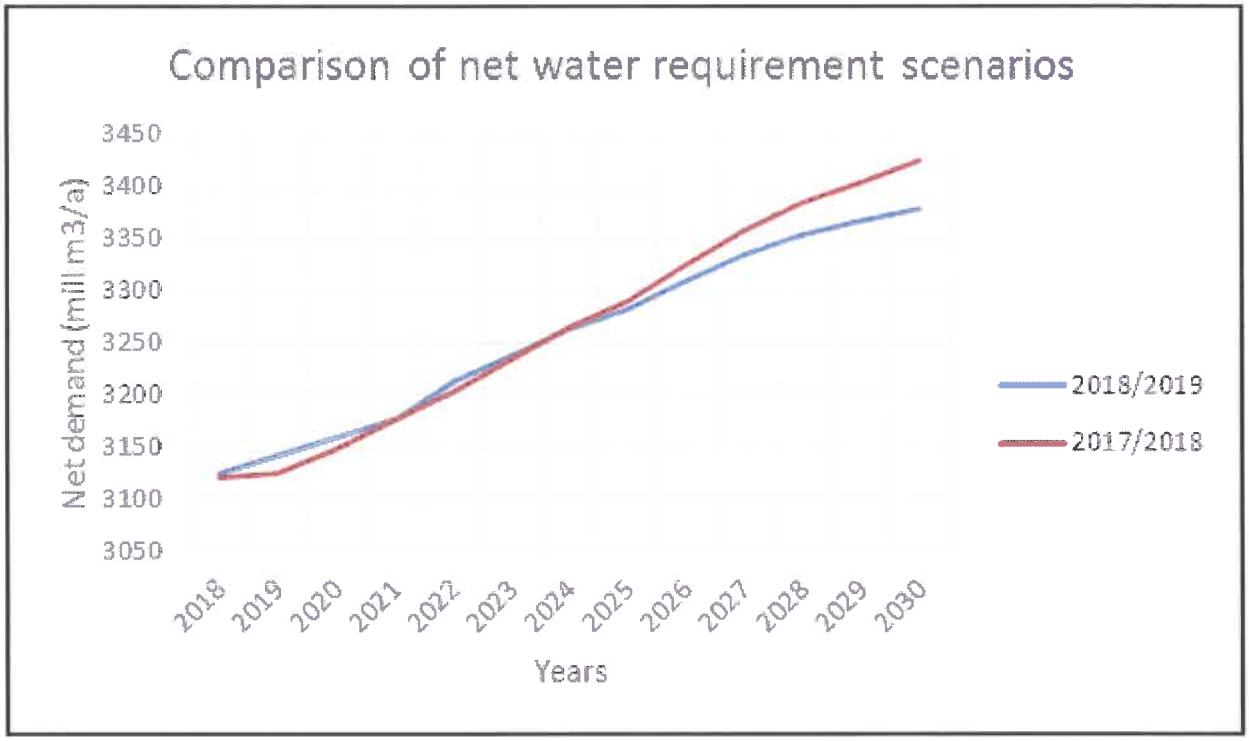

Figure 2.9: Comparison of net water requirement scenarios

3 REFERENCES

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APPENDIX A

Table A-1: Summary of Vaal Water Requirements (Scenario A)

DESCRIPTION		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
DEMANDS:	Rand Water [1]	1589.4	1753.1	1784.1	1816.1	1847.1	1879.1	1912.1	1945.1	1966.5	1995.0	2025.0	2055.0	2086.0	2113.0
	Magalies Water (Vaalkop Scheme) [11]														
	Mittal Steel [10]	8.6	8.7	8.8	9.0	9.1	9.3	9.4	9.6	9.7	9.9	10.0	10.2	10.3	10.5
	ESKOM [8]	323.3	318.0	308.2	303.3	303.4	304.8	302.2	298.3	298.8	300.2	300.0	294.0	279.8	267.7
	SASOL Sasolburg (Raw water req) [9]	20.7	21.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7
	SASOL Secunda [12]	86.0	85.7	86.3	84.1	83.7	83.7	83.7	83.7	88.7	89.1	89.2	89.3	89.4	89.5
	Midvaal Water Company	44.7	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5
	Sedibeng Water (Balkfontein only)	75.2	70.5	71.2	71.8	73.3	74.8	76.3	77.7	74.4	74.9	75.3	75.7	76.1	76.5
	Other towns and industries (Vaal)	272.3	283.2	287.0	291.0	294.8	298.7	302.7	306.7	310.7	314.5	318.4	322.3	326.2	330.3
	Other towns and industries(Zaai)	-23.9	-22.8	-22.9	-23.5	-24.0	-23.1	-22.8	-22.0	-21.4	-20.7	-20.8	-20.9	-20.9	-20.9
	Vaalharts/Lower Vaal irrigation [2]	541.5	541.5	541.5	541.5	541.5	541.5	541.5	541.5	541.5	541.5	541.5	541.5	541.5	541.5
	Diffuse Irrig and Aff (Vaal)	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3
	Diffuse Irrig and AFF (Sub systems)	68.3	68.3	68.3	68.3	68.3	68.3	68.3	68.3	68.3	68.3	68.3	68.3	68.3	68.3
	Other irrigation in Vaal [3]	451.8	451.8	451.8	451.8	451.8	451.8	451.8	451.8	451.8	451.8	451.8	451.8	451.8	451.8
	Other irrigation in sup subsystems [3]	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1
	Wetland losses [4]	46.9	47.2	47.4	47.7	48.0	48.2	48.5	48.7	49.0	49.2	49.5	49.7	50.0	50.2
	Bed losses [5]	267.2	267.2	267.2	267.2	267.2	267.2	267.2	267.2	267.2	267.2	267.2	267.2	267.2	267.2
	Mooi River (net losses) [6]	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
RETURN FLOWS:	Southern Gauteng (Rand Water)	-423.1	-467.1	-475.5	-484.2	-492.2	-500.5	-509.0	-517.4	-524.8	-531.6	-538.4	-545.1	-552.1	-557.9
	Midvaal Water Company	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
	Sedibeng Water	-3.0	-2.8	-2.8	-2.9	-2.9	-2.9	-2.9	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.1
	Other towns and industries	-83.2	-84.7	-86.0	-86.9	-87.7	-88.6	-89.3	-90.0	-91.0	-91.7	-92.3	-92.9	-93.6	-94.5
	Irrigation [7]	-73.7	-73.7	-73.7	-73.7	-73.7	-73.7	-73.7	-73.7	-73.7	-73.7	-73.7	-73.7	-73.7	-73.7
	Mine dewatering	-125.7	-125.7	-125.7	-125.7	-118.1	-77.9	-77.9	-77.9	-77.9	-77.9	-77.9	-77.9	-77.9	-77.9
	Mine Water treated for Re-use	0.0	0.0	0.0	0.0	-16.7	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0
	Increased urban runoff	-109.1	-110.5	-111.9	-113.3	-114.8	-116.3	-117.8	-119.4	-121.0	-122.6	-124.2	-125.9	-127.6	-129.4
OVERALL GROSS SYSTEM DEMAND:		**3822.3**	**3990.8**	**4018.4**	**4047.7**	**4083.6**	**4123.7**	**4160.2**	**4195.9**	**4224.6**	**4260.3**	**4294.8**	**4323.4**	**4345.1**	**4364.9**
OVERALL NET SYSTEM DEMAND:		**3003.4**	**3125.2**	**3141.7**	**3159.9**	**3176.5**	**3212.8**	**3238.5**	**3263.5**	**3282.2**	**3308.8**	**3334.2**	**3353.8**	**3366.2**	**3377.4**

Notes :

(1): Rand Waters total raw water abstraction includes Sasolburg as well as the Sasol Secunda intake of 25 ML/d but excludes Authorised Users (i.e. ESKOM, ISCOR, Sasol Sasol

(2): Includes distribution losses within Vaalharts canal system and mainstream irrigation along Vaal River from Bloemhof Dam down to Douglas Weir.

(3): "Other irrigation" excludes diffuse irrigation

(4): Includes evaporation losses associated with wetlands as well as bed losses occuring within the Suikerbosrand and Klip rivers

(5): Vaal River bed losses include evaporation and operating losses associated with releases made from Bloemhof Dam

(6): Mooi River (Wonderfonteinspruit catchment) : Net effect of bed losses and decanting from dolomitic eyes resulting from WQT calibration

(7): Includes flow contribution resulting from the tailwater component at Erfenis Dam

(8): Includes DWS 3rd Party Users supplied from Eskom conveyance infrastructure as well as from the VRESAP pipeline (i.e. Greylingstad and Burn Stone Mine)

(9): It is assumed that Sasols raw water requirements are not supplied through Rand Water, but that the projections of Rand Water include the potable water allocation of 6M

(10): Represents Mittal Steels total water requirements (i.e. includes the portion of the demand obtained from Rand Water)

(11): Represents portion of Rand Waters demand supplied by Magalies Water (drawn through the Vaalkop Scheme)